Remarks

Claims 1-20 remain in the application. Claim 1 has been amended to emphasize that alumina is added to the cell on a continuous basis. Claim 15 has been amended to delete the word "inert".

Applicants' invention is concerned with maintaining the electrolyte concentration in a low temperature electrolytic cell for production of aluminum from alumina dissolved in the electrolyte. In the higher temperature cells such as in the Hall-Heroult process, the cell operates with a solid crust or layer that covers the molten electrolyte and thus for the periodic additions of alumina to the cell, the crust must be broken. This has the problem that large quantities of emissions such as volatile fluorides are lost from the cell and are usually captured along with emissions from other cells in a bag house. However, each cell operates differently and gives off different amounts of volatiles. Make-up electrolyte is added to the cell based on an average, which is not satisfactory because the average can be too much for one cell and not enough for another. This can require frequent analysis of each cell to maintain the desired electrolyte concentration. Applicants' invention solves this problem by capturing volatile material on alumina as the alumina is fed to the cell on a continuous basis. It should be noted that Applicants' cell ***operates without a frozen crust***, making it possible for the alumina to be added on a continuous basis. Thus, in Applicants' invention, the ***volatile material is returned to the cell that it came from***. Applicants claim this invention with respect to a low temperature cell which operates without a frozen crust. Claim 1 of Applicants' invention is set forth below for convenience:

> 1. (Original) A method of maintaining concentration in a low temperature electrolytic cell used for the production of aluminum from alumina dissolved in a molten salt electrolyte contained in a cell free of frozen crust, the method comprising:
>
> (a) providing a molten salt electrolyte at a temperature less than 900°C;
>
> (b) providing a plurality of anodes and cathodes disposed in said electrolyte;

(c) venting volatile material from said cell through a conduit;

(d) adding alumina on a continuous basis to said cell through said conduit;

(e) capturing said volatile material on said alumina; and

(f) returning said captured volatile material to said electrolyte with said alumina thereby maintaining the concentration in said molten salt electrolyte.

Thus, it will be seen that in Applicants' invention, the ***volatile material is returned directly with the alumina feed to the cell from which it came***. Accordingly, in Applicants' invention, the electrolyte concentration remains relatively constant.

In the Office Action, claims 1-9 and 11-20 were rejected under 35 U.S.C. §103(a) on the basis of Beck et al (U.S. Patent 5,284,562) in view of Gianfranco (U.S. Patent 4,770,752) as follows:

> Beck et al teach the invention substantially as claimed. Beck et al teach (see abstract, figure 6, col. 1, lines 17-60 and col. 11, line 12 to col. 12, line 26) a process for the production of aluminum from alumina dissolved in a molten salt electrolyte contained in a cell free of frozen crust comprising (a) providing a molten salt electrolyte at 660-800°C, (b) providing a plurality of anodes and cathodes disposed in the electrolyte (c) venting volatile material (to the atmosphere) and (d) adding alumina to the cell.
>
> Beck et al do not teach venting the volatile material through a conduit or adding the alumina through the conduit thereby capturing the volatile material on the alumina.
>
> Gianfranco teaches (see abstract, figure 3 and col. 7, lines 29-54) a method whereby the volatile materials from an aluminum smelter are passed through a conduit (21, 22, 27) and are adsorbed onto alumina that is then fed into the molten electrolyte, thereby recycling the volatile material (HF) back into the melt.
>
> Therefore, it would have been obvious to one of ordinary skill in the art to have added the volatile material recycling means of Gianfranco in the process of Beck et al, thereby venting the volatile material through the same conduit as the alumina feed, because the contacting means of Gianfranco provide for recycling of the volatile HF gases, thus reducing losses in the process.

It is respectfully submitted that claims 1-9 and 11-20 are patentable over Beck taken singly or combined with Gianfranco. Beck is concerned with:

> An oxidation resistant, non-consumable anode, for use in the electrolytic reduction of alumina to aluminum, has a composition comprising copper, nickel and iron. The anode is part of an electrolytic reduction cell comprising a vessel having an interior lined with metal which has the same composition as the anode. The electrolyte is preferably comprised of a eutectic of AlF3 and either (a) NaF or (b) primarily NaF with some of the NaF replaced by an equivalent molar amount of KF or KF and LiF.

It is submitted that Applicants' invention is patentable over Beck for a first reason. That is, Applicants' invention requires in claim 1: "(c) venting volatile material from said cell through a conduit". Beck et al are ***silent*** with respect to venting volatile material from the cell through a conduit. Thus, for this first reason, Applicants' invention is not disclosed by Beck et al.

Applicants' invention requires in claim 1 adding alumina, as follows: "(d) adding alumina to said cell through said conduit". Thus, in Applicants' invention, alumina is added through the same conduit through which the volatiles are vented.

It is submitted that Beck et al are ***silent*** with respect to the step of adding alumina to the cell through the same conduit that volatiles are vented. Thus, for this second reason, Applicants' invention is patentable over Beck et al.

It is submitted that Applicants' invention is patentable over Beck et al for a third reason. Applicants' invention requires that the volatiles from the cell be captured on the alumina as it is added to the cell. This is step 1(e), which is as follows: "(e) capturing said volatile material on said alumina". Clearly, Beck et al are ***silent*** with respect to capturing the volatile material on the alumina, and thus for this third reason, Applicants' invention is patentable over Beck et al.

Applicants' invention requires in step 1(f) returning the volatile material to the electrolyte in the cell, as follows: "(f) returning said captured volatile material to said electrolyte with said alumina thereby maintaining the concentration in said molten salt electrolyte." Beck et al are ***silent*** with respect to returning the captured volatile material

to the electrolyte to maintain the concentration in the molten salt electrolyte. Thus, for this fourth reason, Applicants' invention is patentable over Beck et al.

It is respectfully submitted that Applicants' invention is patentable over the combination of Beck et al and Gianfranco. That is, it is submitted that Gianfranco does not supply the steps missing in Beck et al. The Gianfranco reference is concerned with the Hall-Heroult type cell which employs a crust. The U.S. Patent Office refers to Gianfranco at col. 7, lines 29-54, which states as follows:

> Referring to FIG. 3, according to the present invention, the electrolysis fumes are sucked, by the fan 14 which creates intake in the whole equipment, from the chamber defined by the inner vault 15 of crust 16 and the liquid surface of molten bath 17, through the hole 18, provided in the crust, and kept always open by the point crust breaker 19, of known type, automatically actuated according to programmed times by per se known systems and devices not shown in figure. From cap or cover 20, the electrolysis gases, together with air penetrating through the gaps around the crust breaker and between the edge of the rim and the crust surface, are conveyed by the duct 21 to reactor 22, wherein the dragged substances are fixed and retained by alumina. The reactor 22 can be constituted by any device of known type, suitable to place and keep alumina in intimate contact with the fumes, and is preferably an expanded fluidized bed reactor with conveyance, or an injection "Venturi" type reactor.
>
> Fresh alumina is introduced into reactor from 23 and the purified gases, after passing through the filter 24, are discharged to the atmosphere from 25. Reacted alumina is collected in 26 and from here, through ducts 27, is fed to the pot, it being introduced into the molten bath by the traditional devices for crust breaking, preferably of the perforator point type, not shown in figure.

It is respectfully submitted that Applicants' invention is patentable over the combination of Beck et al. and Gianfranco. That is, it is submitted that Gianfranco does not supply the steps missing in Beck et al. The Gianfranco reference is concerned with a Hall-Heroult type cell employing a crust (16). Applicants' invention as claimed requires "a cell free of a frozen crust". Thus, for this first reason, it is respectfully submitted that Applicants' invention is patentable over Beck et al taken in view of Gianfranco.

It is submitted that Applicants' invention is patentable over Gianfranco for a second reason. That is, Gianfranco requires a hole in the crust kept open by point crust breaker 19. In Applicants' invention, no such hole is mentioned and point crust breaker 19 is not required. Thus, for a second reason, Applicants' invention is patentable over Gianfranco.

It is respectfully submitted that Applicants' invention is different from Gianfranco in yet a third way. In Gianfranco (refer to Fig. 3), the gases are pumped along line 21 into a reactor 22 (such as a fluidized bed) wherein the gases are reacted or fixed on the alumina (see col. 7, lines 40-42). Applicants' invention does not require a reactor such as described in Gianfranco. Thus, for this third reason, Applicants' invention is patentable over Gianfranco or Beck et al, or the combination.

It is submitted that Applicants' invention is patentable over Gianfranco for yet another reason. It will be noted in Gianfranco that "reacted alumina" from reactor 22 is collected in 26, as follows:

> Reacted alumina is collected in 26 and from here, through ducts 27, is fed to the pot, it being introduced into the molten bath by the traditional devices for crust breaking, preferably of the perforator point type, not shown in figure.

In Applicants' invention, the "reacted alumina" is not collected in a tank 26. It should be noted that in Applicants' invention, alumina is added to the cell on a continuous basis (see claim 1(d)). In Applicants' invention, if the alumina is not added on a continuous basis, scrubbing of the volatile material with alumina would not work. Thus, it will be seen that for a fourth reason, Applicants' invention is patentable over the combination of Beck et al and Gianfranco.

It will be noted that in Gianfranco, the stored alumina is only added periodically when crusting breaking occurs. Clearly, this is not Applicants' invention. In Applicants' invention, alumina is added continuously. Thus, for a fifth reason, Applicants' invention is patentable over Gianfranco.

It is respectfully submitted that Applicants' invention is patentable for a sixth reason. That is, Applicants' invention requires introducing the alumina ***through the conduit used for venting the volatile material.*** Clearly, Gianfranco uses a separate line or conduit (27) for introducing alumina and a separate line (21) for removing the volatile material (see Fig. 3). Thus, Gianfranco employs a ***different*** invention.

It is submitted that Applicants' invention is patentable over Gianfranco for a seventh reason. That is, Gianfranco is ***silent*** and does not disclose Applicants' method of introducing alumina and capturing volatile material on the alumina as it is introduced to the cell. This is important because it ensures that volatile material is returned to the bath from which it is emitted, thereby maintaining the concentration of the molten salt electrolyte as required by Applicants' claims. Thus, for this additional reason, Applicants' invention is patentable over Gianfranco or Beck et al or the combination.

It is respectfully submitted that there is no basis for combining Beck and Gianfranco except Applicants' application, and the use of Applicants' invention as a roadmap through the art is strictly forbidden. References must somehow teach that they can be combined to produce Applicants' invention within their four corners and ***without*** reconstruction based on Applicants' specification. This law is set forth, for example, in the CCPA case of In re Regal, 188 USPQ 136 (1975), where the Court states as follows:

> ***There must be some logical reason apparent from positive, concrete evidence of record that justifies combination of primary and secondary references***; the mere fact it is possible to find two isolated disclosures which might be combined in such a way to produce a new product does not necessarily render such production obvious ***unless the art also contains something to suggest the desirability of the proposed combination.*** (Emphasis added.)

It is submitted that claims 2-20 are patentable over Beck and Gianfranco for the reasons set forth above. Claim 10 is patentable over the combination of Beck,

Gianfranco and Duruz because Duruz does not supply the parts missing in Beck and Gianfranco.

In view of the above amendments and remarks, it will be noted that a sincere attempt has been made to place this application in condition for allowance. Therefore, reexamination and reconsideration are requested and allowance solicited at an early date.

Respectfully submitted,

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